FAA-E-2003a
April 28, 1972
SUPERSEDING
FAA-E-2003, 5/1/63

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION SPECIFICATION

CABLE, CONTROL, ONE SHIELDED PAIR, INTERIOR

1. SCOPE

1.1 Scope.- This specification covers a one-pair communication type cable having No. 20 AWG stranded conductors, thermoplastic insulation, shielding, and thermoplastic jacket. This cable will be used for interior communication and control applications.

2. APPLICABLE DOCUMENTS

2.1 American Society for Testing Materials.- The following ASTM Standards are applicable to this specification as referenced hereinafter:

B 286	Copper Conductors for Use in Hookup Wire for Electronic Equipment
# D 2287-70	Nonrigid Vinyl Chloride Compounds #
D 1047	Thermoplastic Vinyl Chloride Plastic Sheath Compound for Electrical Insulated Cords and Cables

2.2 National Electrical Manufacturers Association.- The following NEMA Standard is applicable to this specification as referenced hereinafter:

NEMA WC 21	Non-returnable Reels for Wire and Cable

(Copies of this specification may be obtained from the Contracting Officer in the Federal Aviation Administration Office issuing the invitation for bids or request for proposals. Requests should fully identify material desired, the invitation for bids, request for proposals, or the contract involved or other use to be made of the requested material.)

(Information on obtaining copies of ASTM Standards may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa. 19103.)

(Information on obtaining copies of NEMA Standards may be obtained from National Electrical Manufacturers Association, 155 East 44th Street, New York, New York 10017.)

2.2.1 Precedence.- In the event of a conflict between the above-mentioned standards and this specification, this specification shall govern. Standards are referred to by basic number and title; the issue in effect on the date of invitation for bids shall apply.

3. REQUIREMENTS

3.1 Materials.- Materials shall be as specified herein. When materials are used for a purpose for which no material is specified herein, they shall be entirely suitable for such purpose. The manufacturer shall be prepared to show proof that insulation and jacket were made from virgin compounds.

3.2 Workmanship.- Cable shall be manufactured and processed in a careful and workmanlike manner in accordance with good design and high-grade manufacturing practices. The cable shall be free of any imperfections which may affect its serviceability. It shall be substantially circular in cross section.

3.3 Conductors

3.3.1 Size.- Each conductor in the cable shall be 7 by 0.0126 stranded tinned copper conductor, with a 0.45 inch maximum lay.

3.3.2 Materials.- The conductors shall be soft or annealed copper and meet the requirements of ASTM B 286.

3.3.3 Conductor joints.- Joints made in conductors during the manufacturing process may be brazed, using a silver alloy and nonacid flux; or they may be welded. Conductor joints shall be free from lumps and sharp projections. The tensile strength of any section of a conductor, having a factory joint, shall be not less than 85 percent of the tensile strength of an adjacent section of the conductor without a joint.

3.4 Insulation.- Insulation shall be a nominally 0.014 inch wall of # polyvinyl chloride compound conforming to requirements of ASTM D 2287-70, Cell Designation 6-0-6-3-3-E1-X1. Insulation concentricity shall be maintained so that the minimum wall shall not be less than 70 percent of the maximum wall thickness. The minimum wall at any point shall not be less than 90 percent of the nominal. #

3.4.1 Repairs.- Repairs to conductor insulation is permitted, using heat fusing and insulation grade compound.

3.4.2 Color coding.- The insulation of one conductor shall be colored black and the other either natural or white.

3.5 Cabling.- The cable shall be made up of a twisted pair having a lay of 1½ to 2½ inch. A shield and drain wire shall be provided as specified in 3.6 and 3.6.1. The pair may be covered with a dielectric tape if desired for manufacturing reasons.

3.5.1 Capacitance

3.6 Shielding.- A tape shield shall be tightly applied over the core. The shield shall be a layer constructed tape consisting of a minimum of 0.0005 inch thick polyester, cemented to aluminum foil of a minimum of 0.00035 inch thickness. If desired, the tape cement or adhesive may be colored.

3.6.1 Drain wire.- An uninsulated, tinned, stranded 7 by 0.0126 drain wire shall be included with the pair and twisted with the paired conductors. The drain wire shall be in continuous contact with the shield.

3.6.2 Shield application.- The shield shall be applied spirally with the aluminum foil on the underside. The shield coverage of the conductors shall be complete plus a 1/8 inch minimum lap. There shall be no exposed areas of conductors when the shielded pair is coiled around a mandrel three times the shielded pair diameter.

3.7 Jacket.- A polyvinyl chloride jacket shall be applied overall. It shall be colored beige throughout. Jacket wall thickness shall be nominally 0.025 inch. The average thickness at any cross section shall not be less than 90 percent of the nominal thickness. The minimum spot thickness shall not be less than 70 percent of the nominal thickness. Jacket material shall comply with ASTM D 1047.

3.7.1 Rip cord.- A rip cord of suitable material shall be laid longitudinally under the jacket to facilitate removal of the jacket.

3.7.2 Jacket repairs.- Opening of the cable jacket for repair or for any other purpose will not be permitted. Minor jacket defects not in excess of 0.05 inches in size in any direction may be repaired by using heat fusing and jacket grade compound.

3.7.3 Cable identification.- The following information shall be applied with permanent type ink on the jacket at intervals of approximately two feet:

Name of manufacturer
FAA contract number
Additional data as desired by manufacturer

4. QUALITY ASSURANCE PROVISIONS

4.1 General.- Inspection will be witnessed on this cable by a Government representative unless waived in whole or in part by the Contracting Officer. If Government witnessed testing is waived, the contractor shall furnish, in lieu thereof, certified test data showing compliance with the specification requirements. Only one inspection will be required and will be performed at the time the cable is completely manufactured. Any reel of cable offered for inspection but failing to meet the requirements of the tests for the inspection may not be reoffered for a retest without the approval of the Contracting Officer. The following tests shall be performed:

Electrical Tests	Paragraph
Spark Test	4.2.1
Dielectric Test	4.2.2
Insulation Resistance	4.2.3
Conductor Resistance	4.2.4
Grounds and Faults	4.2.5
Shield Test	4.2.6
# Capacitance Test	4.2.7 #

Physical Tests	Paragraph	*Insulation	*Jacket
Insulation Thickness	4.3.1.1	X	
Tensile and Elongation	4.3.1.2	X	X
Jacket Thickness	4.3.1.3		X
Cold and Brittle Temperature	4.3.1.4	X	X
Heat Shock	4.3.1.5		X
Flammability and Flame Retardant	4.3.1.6	X	X
Oil Immersion	4.3.1.7		X

*Where test samples of the size necessary for conformance to ASTM D 2287-70 or D 1047 are required, factory furnished samples from material being used on the order may be substituted.

4.2 Electrical tests

4.2.1 Spark test.- Prior to twisting into pairs, a spark test shall be made on each conductor length. The spark test shall be at 3,000 volts rms AC or, at the option of the contractor, at 6,000 volts DC maintained within plus or minus 5 percent (except during actual spark-over). The insulated conductor shall pass through the electrode at a speed that will cause the insulation to be subjected to the test voltage for a period of time not less than 0.2 second. Factory certification that the conductors conformed to provisions of the spark test will be acceptable.

4.2.1.1 Failure during spark test.- All insulation failures in excess of one per 4,000 feet of conductor shall be repaired. Repairs shall be made with insulation grade compound and heat fusing.

4.2.2 Dielectric test.- Each length of cable shall have a high potential test at 2,000 volts rms AC or, at the option of the contractor, at 2,800 volts DC for a period of a minimum of three seconds. This test shall be made between one conductor of the pair grounded to the shield and the other conductor of the pair. Failure of ten percent or more of the lot of cable being inspected shall be cause for rejection of the entire lot.

4.2.3 Insulation resistance.- Insulation resistance shall be measured # between conductors. Minimum acceptable resistance values shall be 500 megohms per 1,000 feet. Tests shall be performed on a length from each 25,000 feet, or fraction thereof, of cable on order. The resistance # shall be measured with a DC potential of not less than 100 volts.

4.2.4 Conductor resistance.- All cable on order shall be tested. The DC resistance, corrected to 20°C, shall not exceed 10.9 ohms per 1,000 feet.

4.2.5 Grounds and faults.- Each length of cable shall be free from grounds (contacts between a conductor and the shield), open circuits, and short circuits.

4.2.6 Shield test.- The shield shall be tested for continuity.

4.2.7 Capacitance test.- A capacitance test shall be made on the finished cable. This test may be made on the specified cable shipping length or on samples therefrom. Nominal capacitance per foot between conductors shall be 49 picofarads and 83 picofarads between one conductor and the other conductor connected to the shield. A ten percent plus tolerance over the nominal will be acceptable. The test shall be made on a minimum of two pair from each twenty thousand feet or fraction thereof of cable on order.

4.3 Physical tests

4.3.1 Samples.- Samples for testing shall be taken from each 25,000 feet or fraction thereof of cable on order. The number of test samples shall be in accordance with ASTM D 2287-70.

4.3.1.1 Insulation thickness.- The wall thickness shall comply with requirements of Paragraph 3.4.

4.3.1.2 Tensile and elongation test.- The insulation and jacket shall comply with requirements of ASTM D 2287-70 or D 1047, whichever is applicable.

4.3.1.3 Jacket thickness.- The cable jacket shall comply with paragraph 3.7.

4.3.1.4 Cold bend and brittle temperature test.- The insulation and jacket shall be tested for conformance to ASTM D 2287-70 or D 1047, as applicable.

4.3.1.5 Heat shock test.- The jacket shall be tested for conformance to ASTM D 1047.

4.3.1.6 Flammability and flame retardant test.- The insulation and jacket shall be tested for conformance to ASTM D 2287-70 or D 1047, as applicable.

4.3.1.7 Oil immersion test.- The jacket shall be tested for conformance to ASTM D 1047.

4.4 Sampling

4.4.1 Referee samples.- When so stated in the invitation for bids or when later requested by the Contracting Officer, in writing, samples of the completed cable shall be supplied to a testing laboratory selected by the Contracting Officer. Such samples shall be not less than 10 feet long and shall be selected on the basis of one sample for the first 25,000 feet or fraction thereof of the completed cable, one of the next 25,000 feet or fraction thereof, and one for each additional 50,000 feet or fraction thereof.

5. PREPARATION FOR DELIVERY

5.1 General.- Cable shall be delivered on nonreturnable reels. The cable shall be in one continuous length for each reel.

5.2 Reel construction.- Cable shall be delivered on reels complying with NEMA Standard WC-21, Table I for Wood Reels. Reels shall be lagged with a minimum of nominal one inch by two inch No. 2 common lumber, lagging to be edge to edge around circumference, strapped with two or more steel straps outside of lagging. Each reel shall be identified by a number plainly marked thereon. This number shall be used in identifying the reel during the testing and inspection operation and shall identify the reel upon delivery and billing to the consignee.

5.3 Reel marking.- Unless otherwise specified, each reel shall be numbered serially and plainly marked on both ends with the manufacturer's name, the contract or order number, the quantity, size and type of the cable on the reel, and the name and address of the consignee. Markings shall be made with permanent type ink or paint.

6. NOTES

6.1 Note on information items.- The subparagraphs below are only for the information of the Contracting Officer, intended to assist him in formulating a contract. They are not contract requirements, nor binding on either the Government or the contractor, except to the extent that they may be specified elsewhere in the contract as such. Any reliance placed by the contractor on the information in these subparagraphs is wholly at the contractor's own risk.

6.1.1 Cable lengths.- Procurement provisions should include requirements for quantities of cable per reel, with suitable tolerances per reel and for the total amount delivered.

* * * * *